UNDERSTANDING

UNDERSTANDING

- **UNDERSTANDING** — COMPREHENSION **SENSE MAKING**
- **KEY QUESTIONS** — WHAT IS COMPLEXITY? **HOW BRAIN DEALS WITH IT?** WHAT IS THE MODEL?
- **APPLICATIONS** — OPERATOR DECISION AIDING **DECISION COORDINATION**
- **RESEARCH** — WHAT IS NEW AND DIFFERENT WHAT IS BEING DONE NOW **WHAT WE WANT TO DO**

COMPREHENSION VS. SENSE MAKING

"The act of grasping, the capacity to apprehend general relations of particulars, the power to make experience intelligible by applying concepts and categories. " Webster's Dictionary.

AN INDIVIDUAL DM

PROBLEM: COMPLEXITY REDUCTION

"An agreement of opinion or feeling, adjustment of differences, a mutual agreement not formally entered into but to an extent binding on each side." Webster's Dictionary

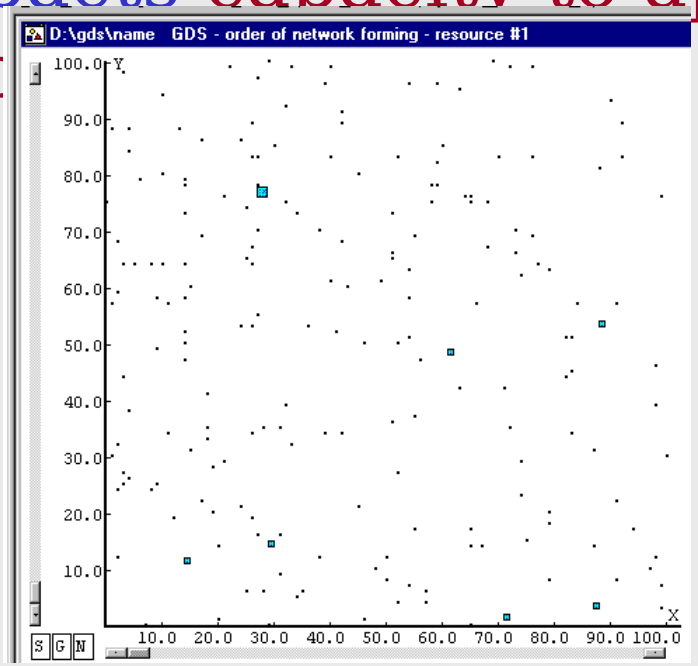
COLLABORATING DMs

PROBLEM: COORDINATION

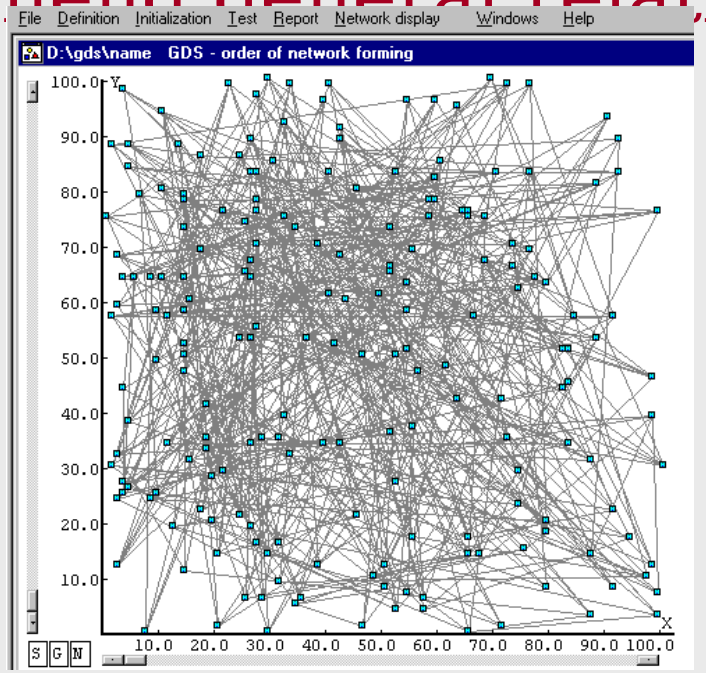
WHAT IS COMPLEXITY?

COMPUTATIONAL COMPLEXITY, INFORMATIONAL COMPLEXITY, PSYCHOLOGICAL COMPLEXITY, …..**COGNITIVE COMPLEXITY**

Impacts capacity to apprehend general relations of p



NUMBER OF PARTICULARS



NUMBER OF RELATIONS

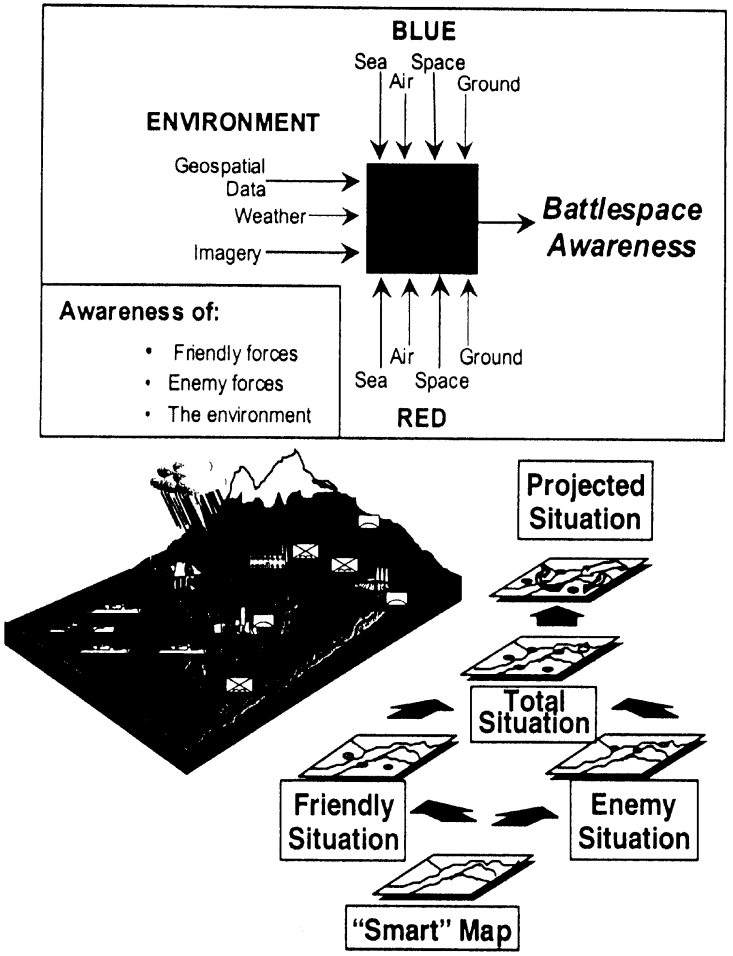
IMC/MVRI

espace Awareness and Common Operational Picture (C

Elements of the COP:

- Location (current positions, rate of movement, position predictions).
- Status (readiness, logistics, sustainability)
- Available courses of actions for both enemy and friendly forces
- The environment (current and predicted weather, sight lines, sea conditions, trafficability)

Alberts et al, 1999



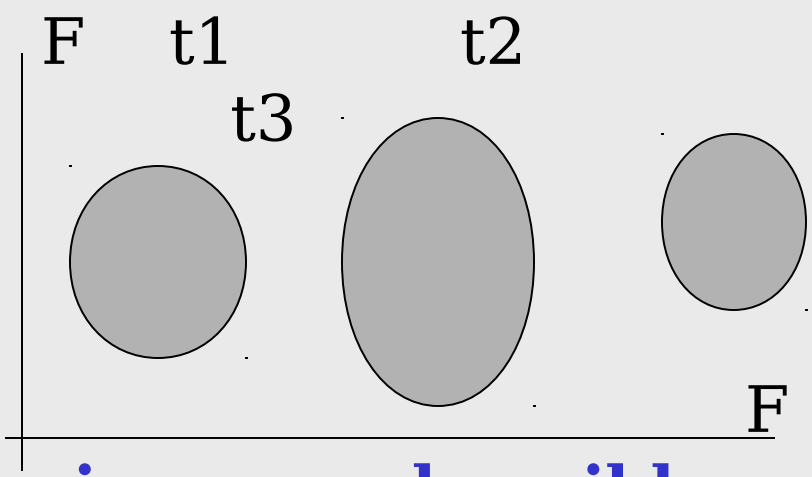
Elements of Battlespace Awareness

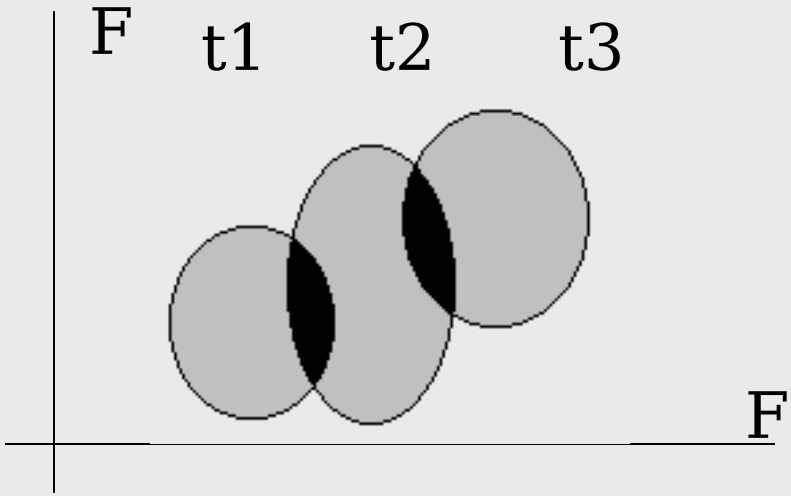
WHAT IS COMPLEXITY?

Number of particulars (Features, variables, entities)

Number of relations

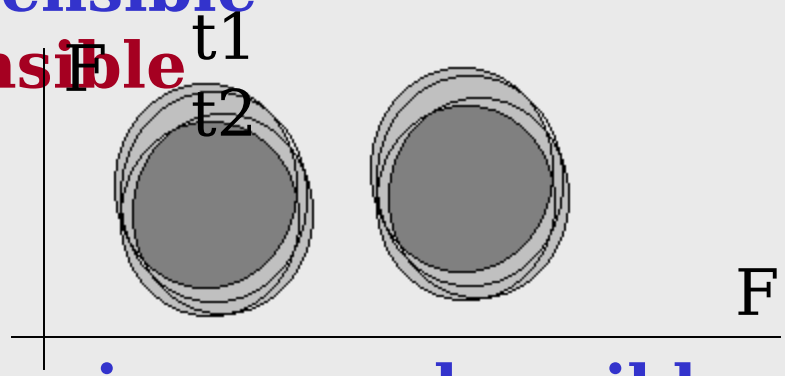
Dynamics





incomprehensible

comprehensible



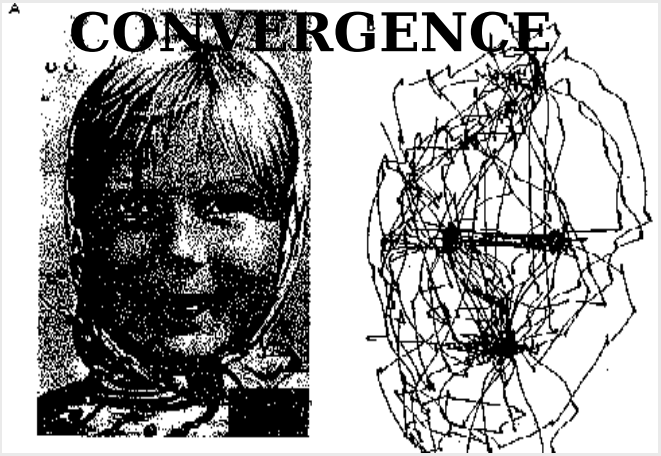
incomprehensible and unrealistic

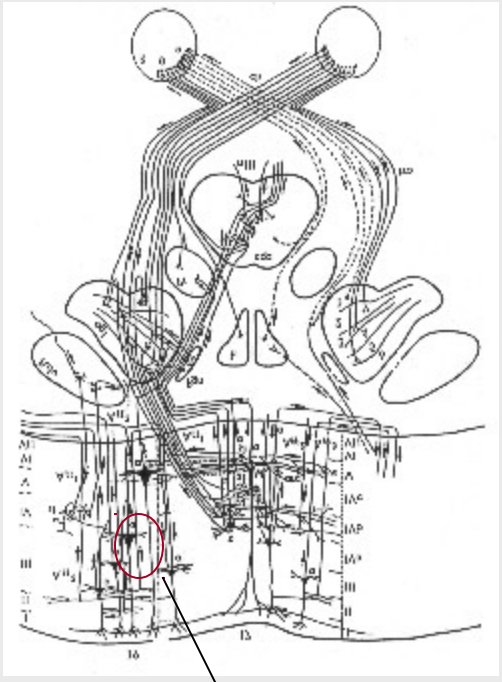
HOW BRAIN DEALS WITH COMPLEXITY

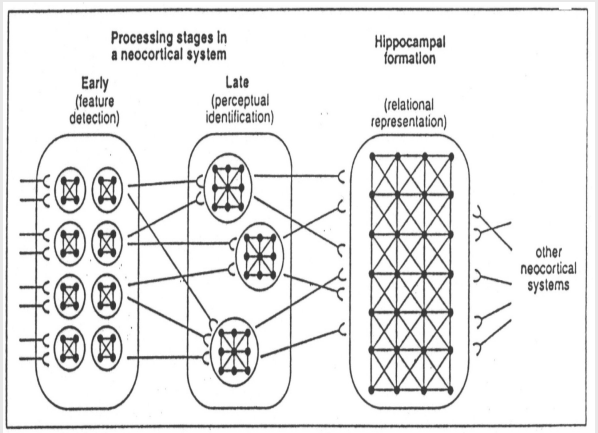
CONSTRUCTIVELY: RESPONSES ARE CONSTRUCTED, NOT RETRIEVED

INTERLOCKING HIERARCHIES

SERIAL INPUT CONVERGENCE



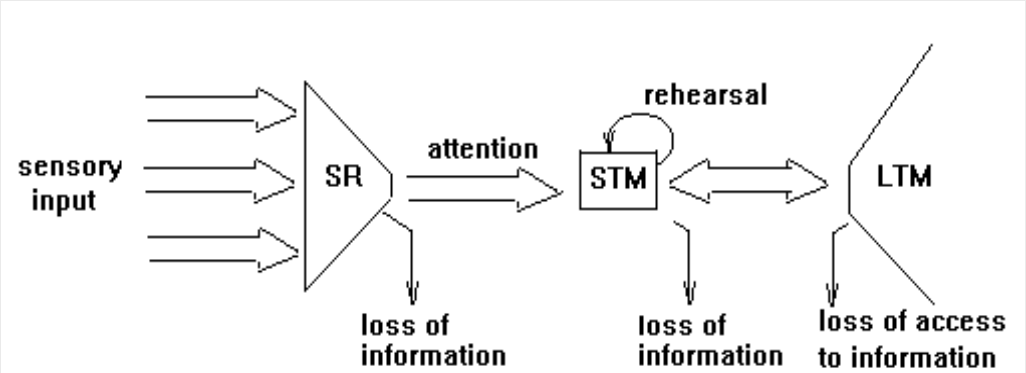




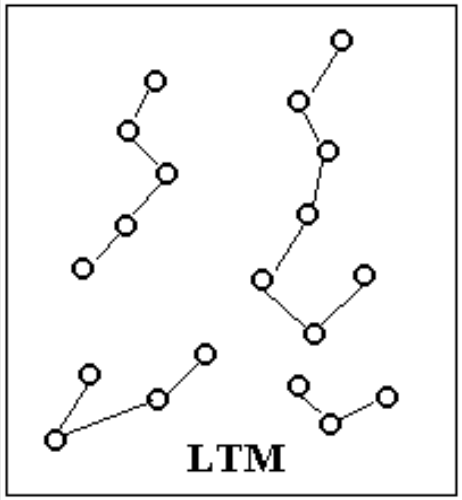
DYNAMIC NEURONAL ENSEMBLES

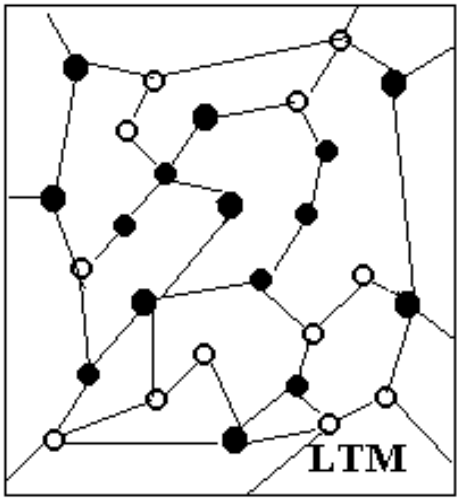
IMC/MVRI

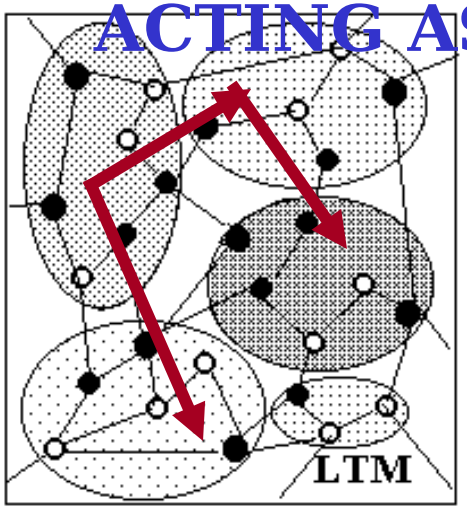
VAN MODEL OF COMPREHENSION



FEATURE OVERLAPS GENERATE COHESIVE NEURONAL ENSEMBLES ACTING AS "UNITS"





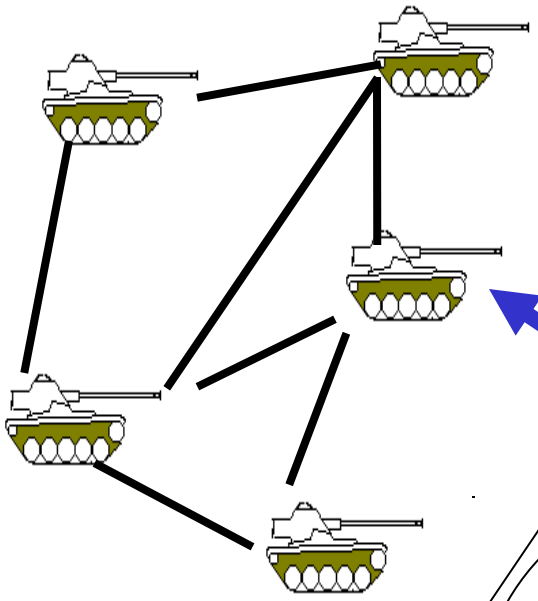


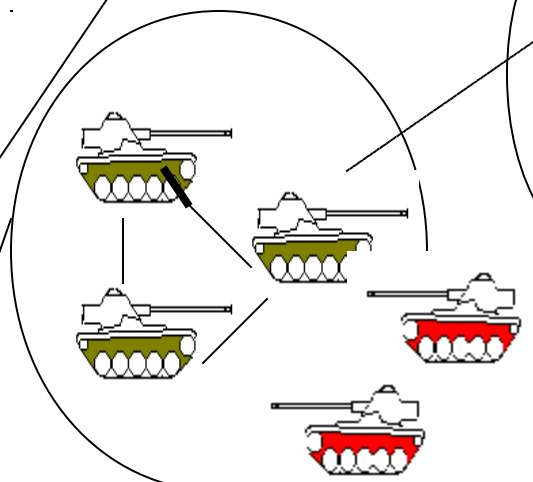
COMPLEX RESPOSNES ARE CONSTRUCTED DYNAMICALLY FROM "UNIT RESPONSES"

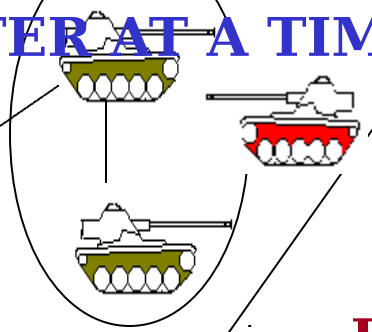
1. SCANNING THE BATTLESPCE AND FORMING A NETWORK OF ENTITIES AND RELATIONS

2. PARTITIONING THE NETWORK INTO COHESIVE CLUSTERS

3. PROCESSING ONE CLUSTER AT A TIME

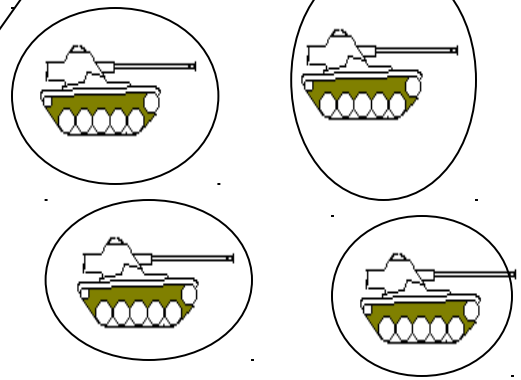






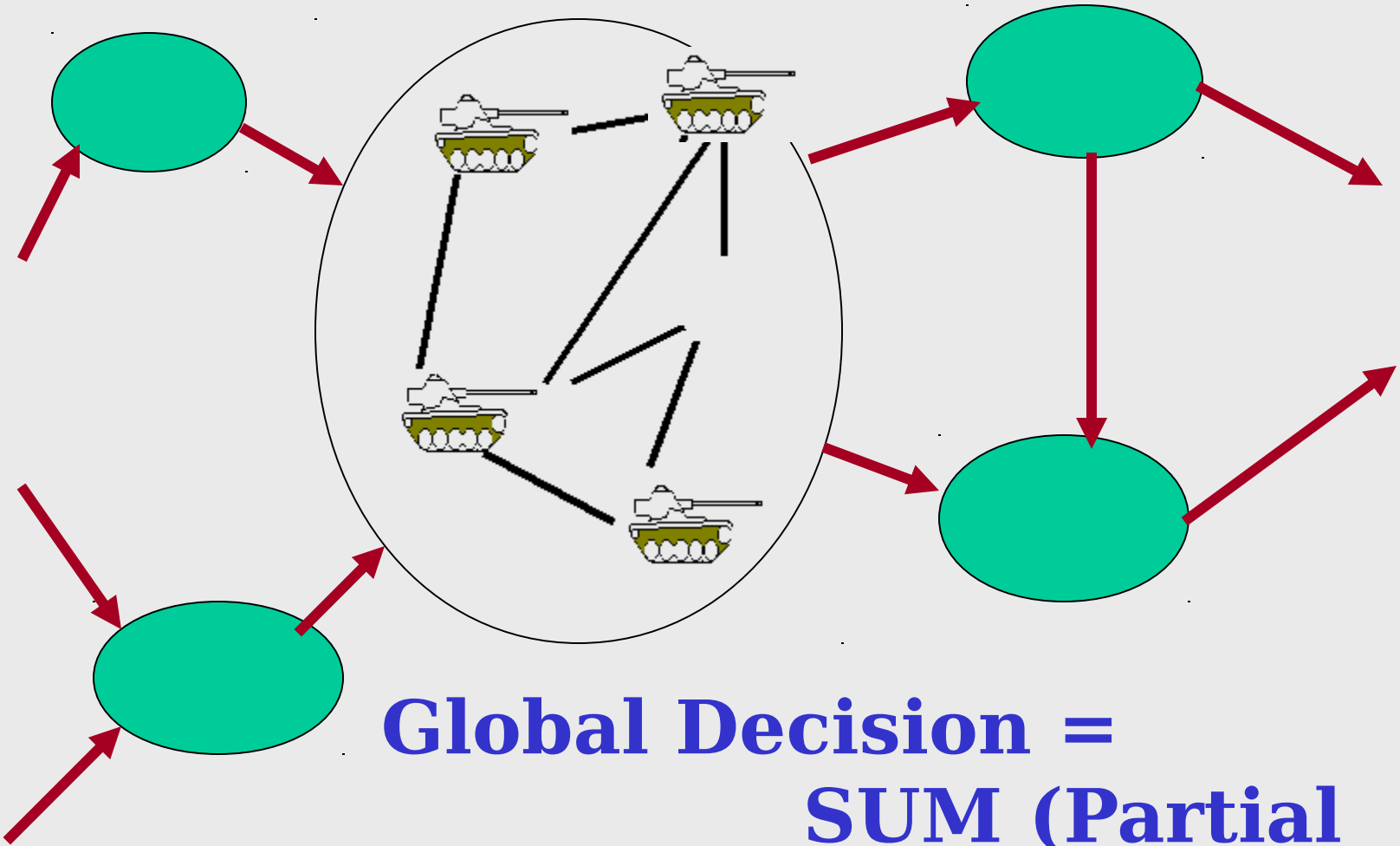
1,2,3 COMPREHENSION PROCESS

LOSS OF COMPREHENSION



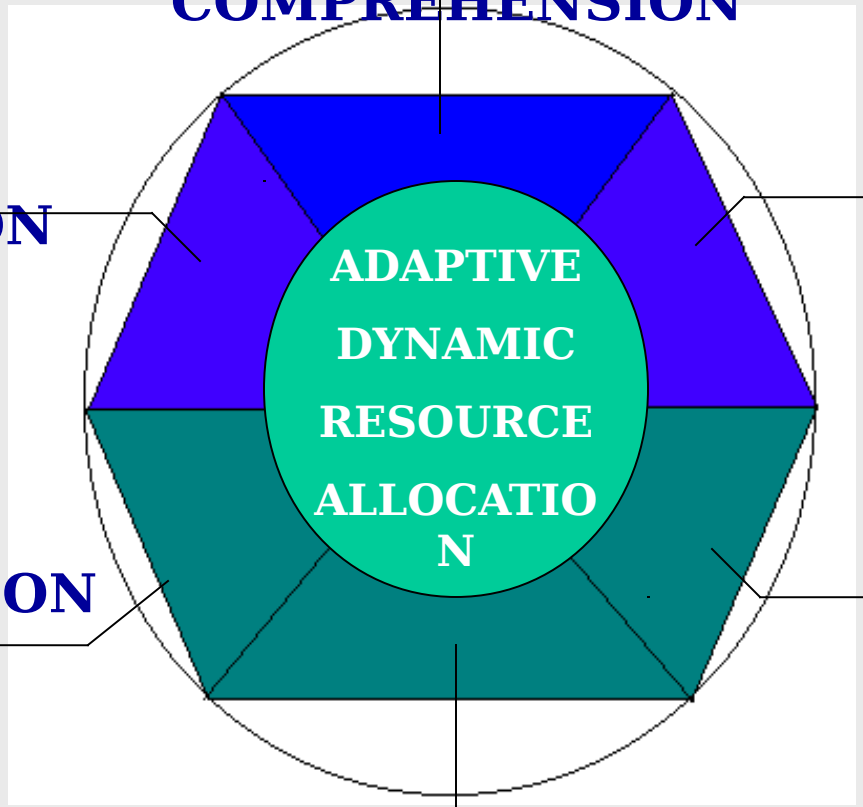
IMC/MVRI

DECISION CONSTRUCTION AND COMPLEXITY REDUCTION



Global Decision = SUM (Partial Decisions)

VAN APPLICATIONS IN NCW



APPLICATIONS

LARGE-SCALE WEAPON ALLOCATIONS (BMD)

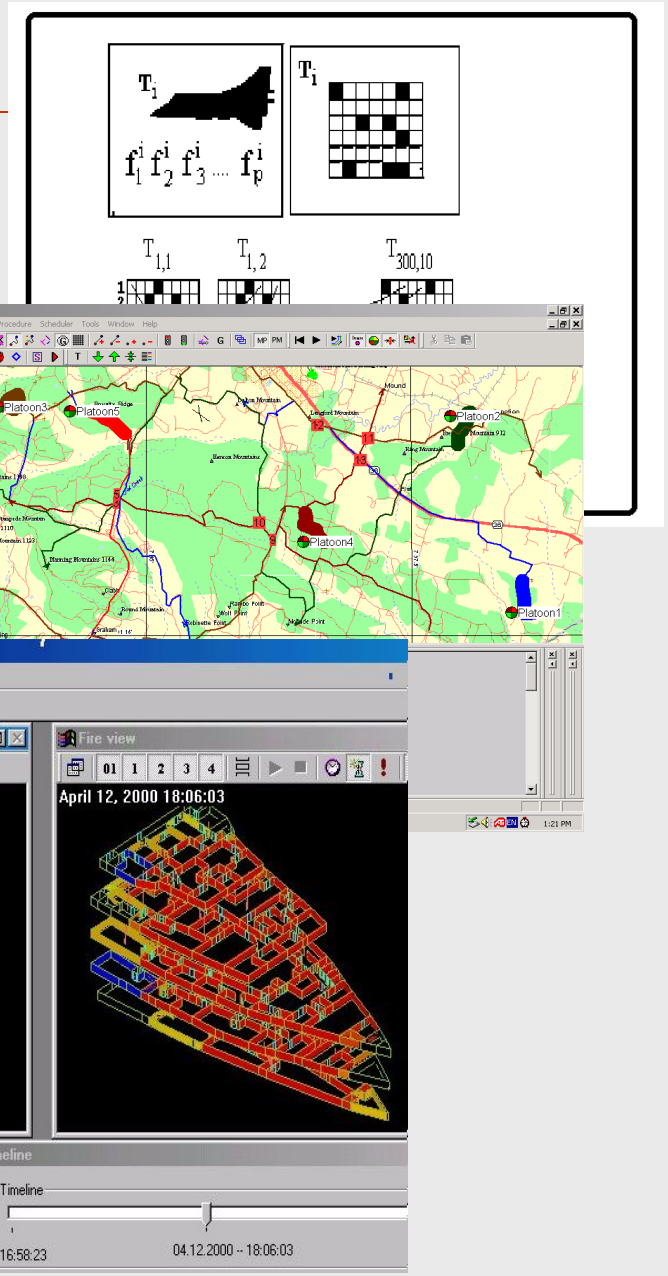
ADAPTIVE DAMAGE CONTROL (NAVSEA)

LARGE-SCALE SENSOR MANAGEMENT (WPAFB)

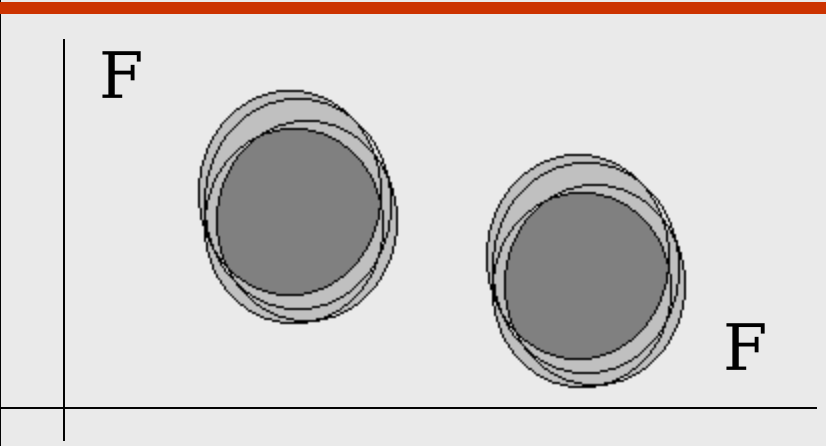
ROUTING AND FORCE COORDINATION (CECOM)

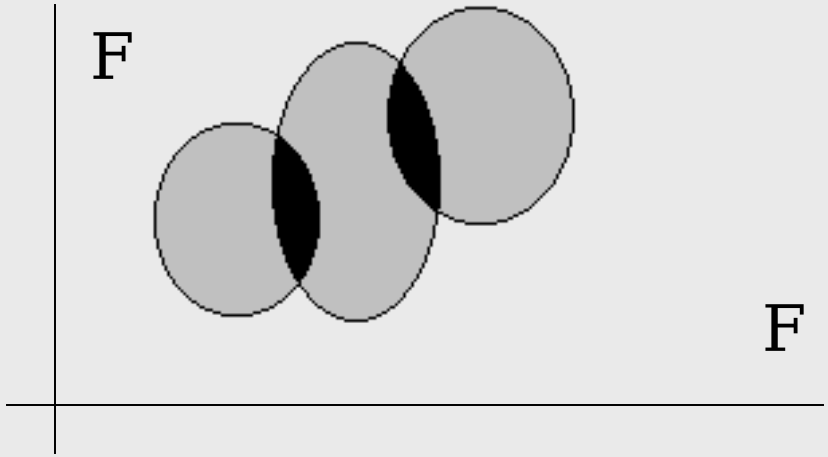
AIR TRAFFIC CONTROL (FAA/NASA)

PILOT-AIRCRAFT INTERFACE OPTIMIZATION (NASA)



HOW IS VAN DIFFERENT FROM OTHER MODELS?





RPDM

SCHEMAS

SCRIPTS

SCENARIOS

CASES

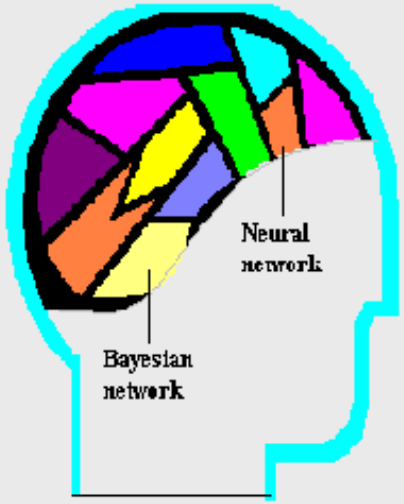
RULES

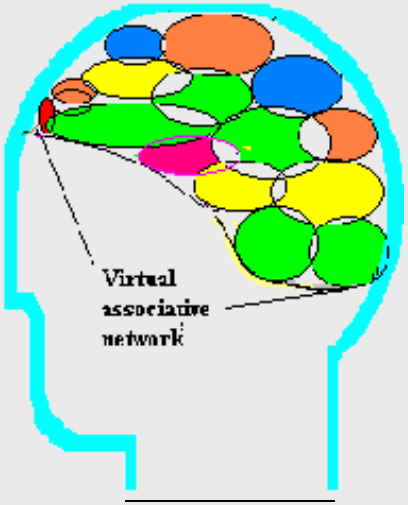
VAN

HOLONOMIC MODELS

NLD MODELS

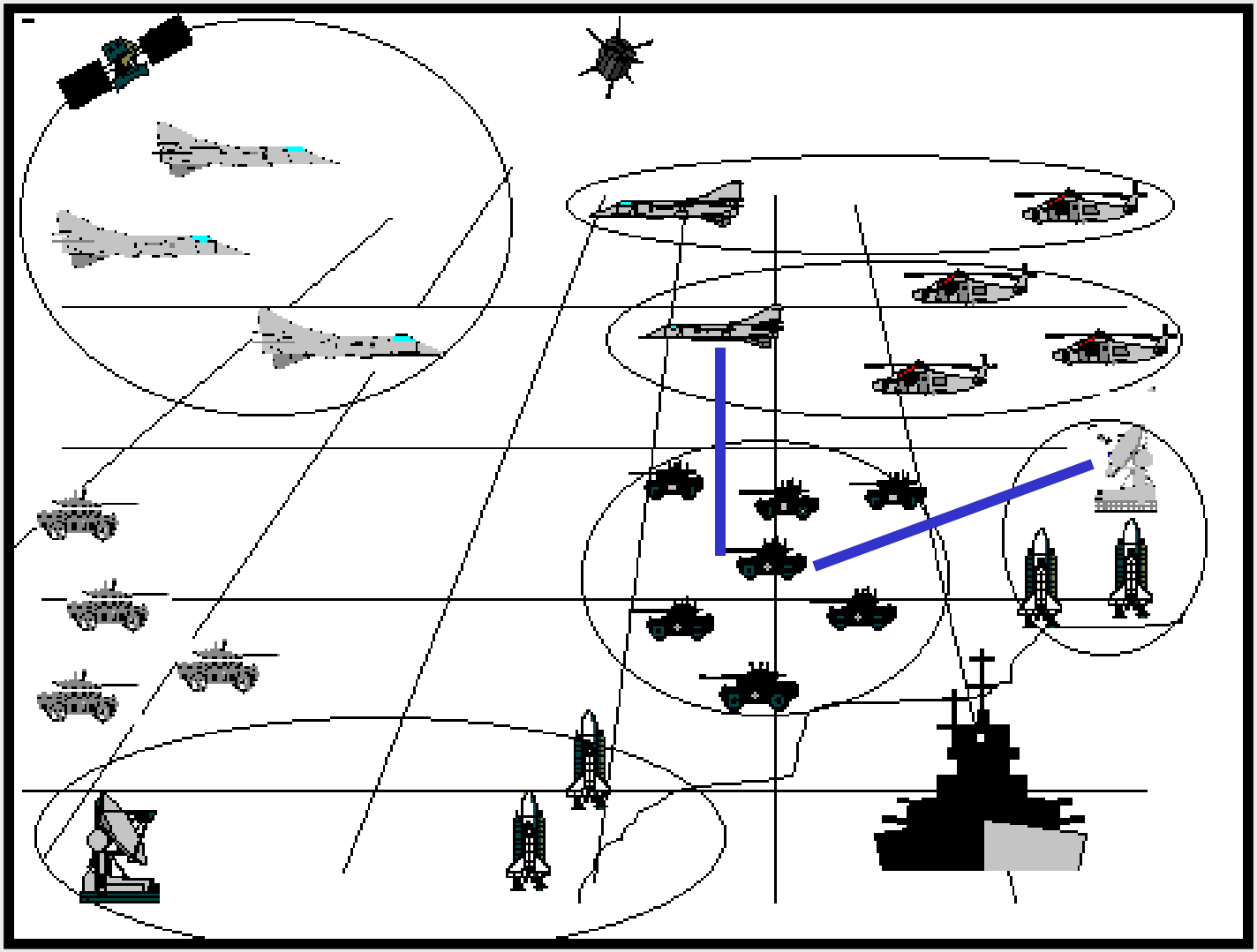
ANALYSIS-BY-SYNTHESIS



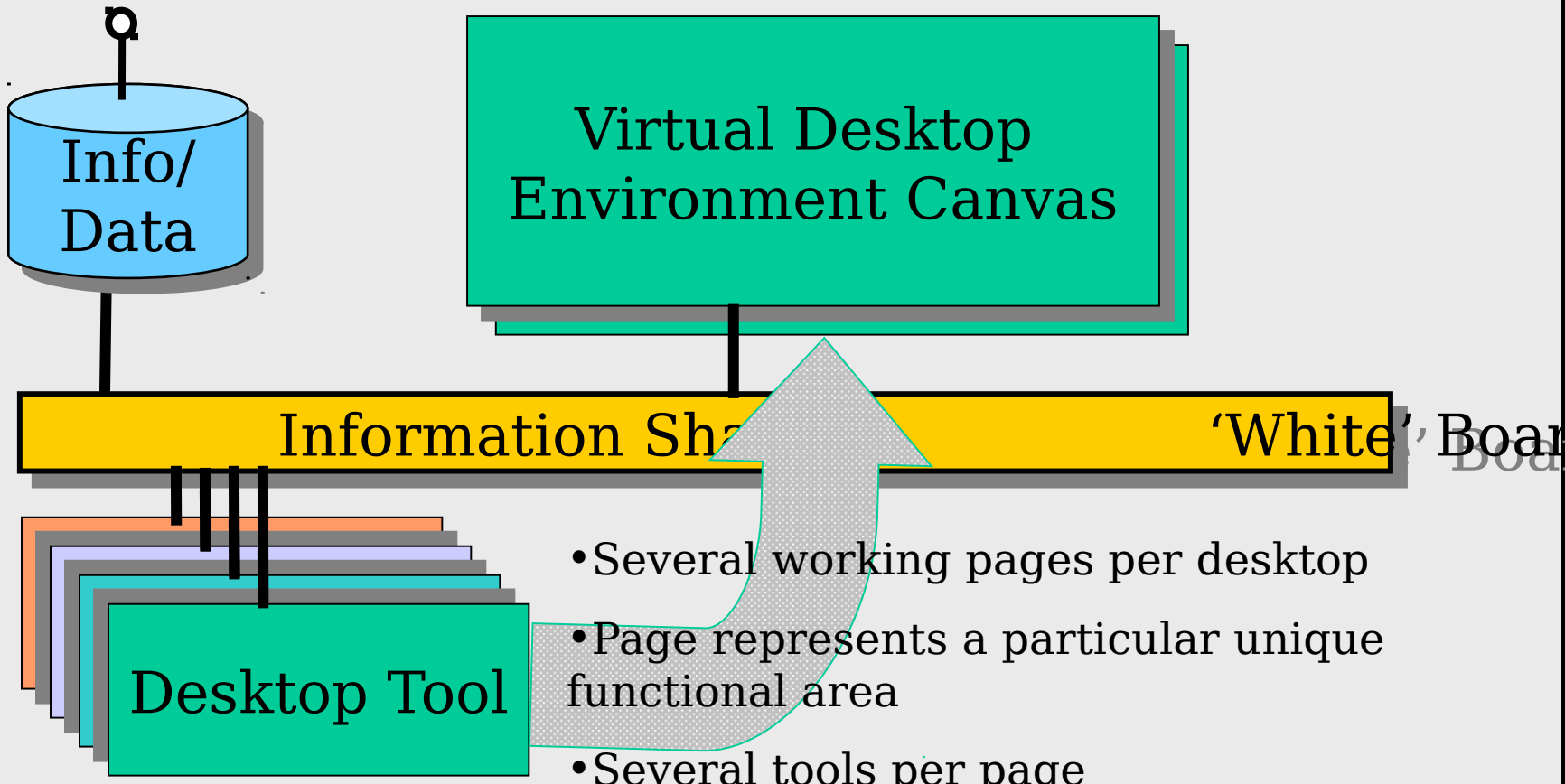


IMC/MVRI

SENSE MAKING APPLICATIONS: INFORMATION PARTITIONING AND OPTIMIZED DISTRIBUTION



Virtual Desktop Environment



- Several working pages per desktop
- Page represents a particular unique functional area
- Several tools per page
- Tools are dragged and dropped
- Tools share information and services
- User default customization

FURTHER RESEARCH

STUDY MEMORY DYNAMICS AS A FUNCTION OF SITUATION COMPLEXITY AND DYNAMICS

DESIGN AND VALIDATE MEASURES OF SITUATION COMPREHENSION

APPLY SCM TO DYNAMICALLY OPTIMIZE INDIVIDUAL AND GROUP PERFORMANCE

UNDERSTANDING UNDERSTANDING:

MODELING COGNITIVE MECHANISMS OF COMPREHENSION IN ~~COMPLEX DYNAMIC~~ TASKS

YAN YUFIK AND APOSTOLOS GEORGOPOULOS

INSTITUTE OF MEDICAL CYBERNETICS

MINNESOTA VETERANS RESEARCH INSTITUTE